

PATENT SPECIFICATION



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COMPLETE SPECIFICATION

Method of Welding Together Tubes and other Elements of Quartz, Hard Glass and other Refractory Materials

We, W. C. HERAEUS GESELLSCHAFT
MIT BESCHRÄNKTER HAFTUNG, of Hanau-
on-Main, Germany, a German Company,
do hereby declare the nature of this in-
5 vention and in what manner the same is
to be performed, to be particularly de-
scribed and ascertained in and by the
following statement:—

When it is desired to join together two
10 pieces of quartz, quartz glass and like
tubing it is usually effected by suitably
softening the ends to be joined, bringing
the two parts together, and then treating
15 the weld so formed by blowing and draw-
ing, whereby a uniform wall thickness is
obtained. This method has also been
applied to fused silica in the form of
quartz glass and quartz material, but,
where large dimensions and wall thick-
20 nesses are concerned, the method gives
rise to difficulties, so that it is generally
thought inadvisable to weld objects of
quartz, quartz glass or like material,
with wall thicknesses of more than 3
25 millimetres.

The present invention has for its object
to provide a method which will enable
quartz and quartz-glass parts of large
wall thicknesses to be welded together
30 satisfactorily. According to the inven-
tion, this object is achieved by making
the connecting point in the form of a re-
cessed joint of such depth that absolutely
no, or only a small, wall thickness re-
35 mains at its base. By this means, the
welding flame is enabled not only to heat
the entire cross-section sufficiently uni-
formly and to a sufficiently high tem-
perature, but also to soften the innermost
40 portion of the wall. If additional mate-
rial of the same kind is then introduced
into the joint, in the form of grains or
rods, it is possible, without great diffi-
culty, to close the joint step by step, if,
45 as is essential with large dimensions the
two objects to be joined are secured in
their relative positions. Since, in this
case, only the joint itself need be heated,
no deformation and thickening occur.
50 Subsequent blowing and drawing opera-
tions and mechanical treatment of the
weld are therefore hardly necessary. On
the other hand, with large dimensions

and wall thicknesses appropriate care in
cooling is called for, and it is desirable,
if possible, to stop up the cavities in close
proximity to the weld, in order that dis-
55 turbing air currents may be suppressed.

It is well-known *per se* to weld joints
in quartz objects, but the methods 60
hitherto employed differ substantially
from the present method.

For instance, quartz rings have been
made by welding together the ends of a
bent quartz strip, by filling the joint with 65
sand, and heating same both internally
and externally. Furthermore, quartz
plates have also been welded together by
treating the surfaces to be united, bring-
70 ing them into intimate contact and then
heating them externally. In contradis-
tinction to this, in the method according
to the present invention the joint remains
open, so that an electric arc or blowpipe
75 flame can enter and directly heat the
walls, and even with the maximum wall
thickness raise them to temperatures even
higher than can be obtained by external
heating, whereby a better connection of
the two parts to be joined results. 80

The new process is not restricted to
materials which acquire a viscous semi-
fluid condition in which they may be
joined but can be applied to all materials
which acquire sufficient strength merely 85
by sintering. In this case, the additional
material introduced into the joint is intro-
duced in the form of more or less fine
grains, preferably while the flame is ap-
plied. In order to obtain the desired 90
degree of sintering with such materials,
either provision is made for matching the
flame temperature to the grain size, as
can be done, for instance, by varying the
95 distance of the burner employed from the
work, or by regulating the quantity of
material supplied to the joint.

The value of the method lies in the
fact that the assemblage of thick-walled
vessels of glass, quartz glass, other quartz 100
materials, corundum and other sinterable
materials is now possible. For instance,
tubes which could hitherto neither be
manufactured nor conveyed in compara-
105 tively great lengths can now be made as
long as desired, and tubes of quartz mate-

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rial which hitherto had to be assembled from short pieces by means of sleeve connections can be combined into a closed tube without the introduction of sealed or packed joints.

An embodiment of the method according to this invention is diagrammatically illustrated in the accompanying drawing, by way of example, in which the single Figure shows in cross section the form of a joint at the commencement of operation. The parts 1 and 2 are the two parts to be joined and it can clearly be seen that the surfaces 3 and 4 thereof diverge from one another. 5 is an arc or blower flame which is directed between the surfaces 3 and 4.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Method of welding together parts of refractory weldable material which comprises forming a recessed joint between said parts, heating the opposed walls of the joint over their entire extent and in-

roducing additional material of the same kind as said parts into said joint while further heating same.

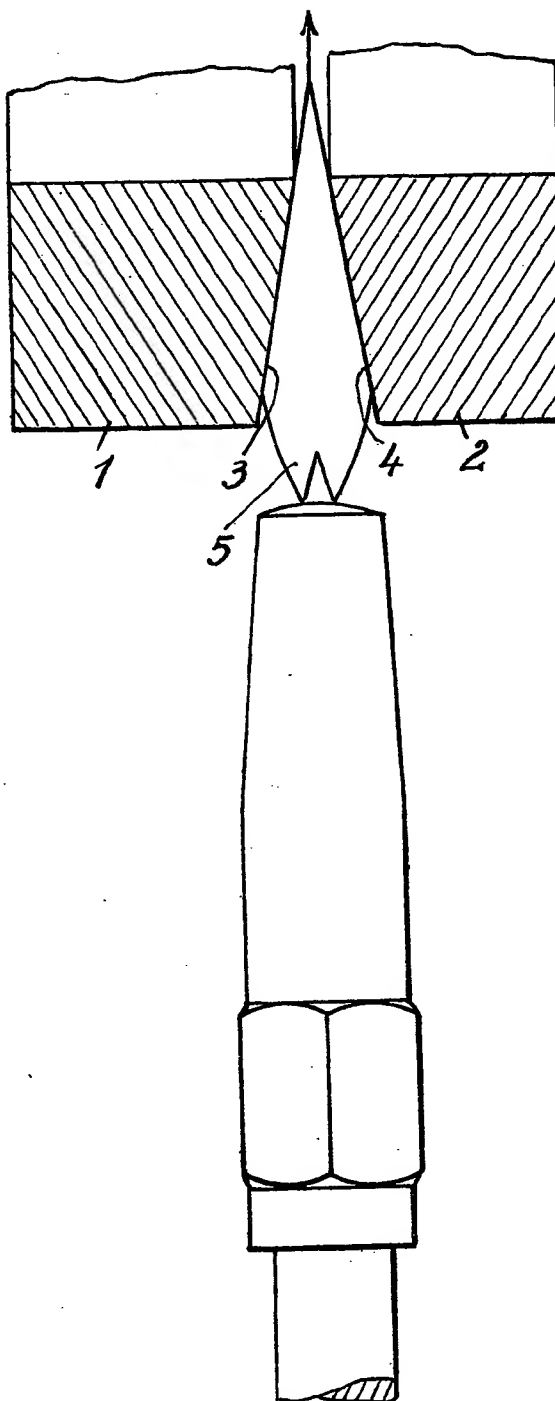
2. Method of welding together parts of refractory fusible material such as quartz, which comprises bevelling the surfaces to be united, bringing said bevelled edges together, heating the opposed surfaces of said bevelled edges over their entire extent and introducing further material of the same kind into the space enclosed between said edges while supplying further heat thereto.

3. As an article of manufacture, two parts of refractory fusible material such as quartz united by a welded joint, said joint being formed between opposed bevelled surfaces of said parts, the space between which is filled with material of a like kind to said parts intimately connected to the walls of said joint over the entire extent thereof.

Dated this 24th day of December, 1935.

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[This Drawing is a full-size reproduction of the Original.]



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